09/674468

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 26123GWW/MDA	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. PCT/NZ00/00125	International Filing Date *(day/month/year)* 13 July 2000	Priority Date *(day/month/year)* 13 July 1999

International Patent Classification (IPC) or national classification and IPC

Int. Cl. [7] G06F 17/60

Applicant

COMPUDIGM INTERNATIONAL LIMITED et al

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   [X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of **8** sheet(s).

3. This report contains indications relating to the following items:

I	[X]	Basis of the report
II	[ ]	Priority
III	[ ]	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	[ ]	Lack of unity of invention
V	[X]	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	[X]	Certain documents cited
VII	[ ]	Certain defects in the international application
VIII	[ ]	Certain observations on the international application

Date of submission of the demand	Date of completion of the report
30 January 2001	11 September 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **MICHAEL HARDY** Telephone No. (02) 6283 2547

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/NZ00/00125

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed.

☒ the description, pages **4 to 12,** as originally filed,
pages , filed with the demand,
pages **1 to 3,** received on **23 August 2001**

☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages **13 to 17 (claims 1 to 33),** received on **23 August 2001**

☒ the drawings, pages **1/7 to 7/7,** as originally filed,
pages , filed with the demand,
pages , received on with the letter of

☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/fig.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	**1 to 33**	**YES**
	Claims		**NO**
Inventive step (IS)	Claims	**1 to 33**	**YES**
	Claims		**NO**
Industrial applicability (IA)	Claims	**1 to 33**	**YES**
	Claims		**NO**

2. Citations and explanations (Rule 70.7)

US-5819226-A (GOPINATHAN et al.) 6 October 1998

US-5774868-A (CRAGUN et al.) 30 June 1998

Patent Abstracts of Japan, JP-10005413-A (FUJI ELECTRIC CO., LTD.) 13 January 1998

US-5444820-A (TZES et al.) 22 August 1995

New independent claims 1, 6, 11, 17, 23, and 28 now refer specifically to predicting interactions between customers and individual gaming machines. The only cited prior art that is relevant to these claims is JP-10005413-A (FUJI ELECTRIC CO., LTD.), the other cited documents being background art only in respect of the invention as now claimed. JP-10005413-A discloses a neural network system for forecasting the behaviour of patrons in a pachinko game parlour, but it does not teach or suggest predicting future interactions between customers and *individual gaming machines*. Rather, the prior art is concerned with forecasting income for the gaming parlour as a whole using models of individual customers and gaming machine types. The claimed invention has the advantage over the prior art in that the value of each individual machine within the casino can be assessed. The prior art does not have this capability.

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date *(day/month/year)*	Filing date *(day/month/year)*	Priority date (valid claim) *(day/month/year)*
US-6032125	29 February 2000	22 October 1997	7 November 1996
US-6029139	22 February 2000	28 January 1998	28 January 1998

US-6032125 (ANDO) discloses a neural network system for forecasting demand for a product based on historical data of fluctuating sales results for the product.

US-6029139 (CUNNINGHAM et al.) discloses a system for evaluating and optimising promotional plans for products. The system uses a neural network to predict customer behaviour towards the product based on changes to promotional plans for the product.

Neither document is relevant to the invention as now claimed in new claims 1 to 33.

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure *(day/month/year)*	Date of written disclosure referring to non-written disclosure *(day/month/year)*

INTERACTION PREDICTION SYSTEM AND METHOD

FIELD OF INVENTION

The invention relates to an interaction prediction system and method, particularly but not solely designed for predicting future revenue from individual gaming machines in a casino.

BACKGROUND TO INVENTION

The low cost of data storage hardware has led to the collection of large volumes of data. Merchants, for example, generate and collect large volumes of data during the course of their business. To compete effectively, it is necessary for a merchant to be able to identify and use information hidden in the collected data. This data could include revenue from gaming machines in a casino. The task of identifying this hidden information has proved very difficult for merchants.

Traditionally, analysis of data has been achieved by running a query on a set of data records stored in a database. The merchant or other party first creates a hypothesis, converts this hypothesis to a query, runs the query on the database, and interprets the results with respect to the original hypothesis.

One disadvantage of this verification-driven hypothesis approach is that the merchant must form the desired hypothesis in advance. This is merely confirming what the merchant already suspects and does not provide the merchant with information which may be unexpected. Another disadvantage is that the merchant needs to have available the technical knowledge to formulate what are often very difficult and complex queries.

SUMMARY OF INVENTION

In broad terms the invention comprises an interaction prediction system comprising a memory in which is maintained a neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier; a retrieval component arranged to activate the neural network and to retrieve prediction data representing future interactions between customers and individual

gaming machines; and a display arranged to display a representation of the prediction data.

In another form in broad terms the invention comprises a neural network training system comprising a memory in which is maintained an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier; a retrieval component arranged to retrieve from the interaction database data representing interactions between customers and gaming machines; a neural network arranged to receive input data representing the data retrieved from the interaction database and to output prediction data representing future interactions between customers and individual gaming machines predicted by the neural network; and a training component arranged to compare the data retrieved from the interaction database and the prediction data and to adjust the neural network based on the comparison.

In another form in broad terms the invention comprises an interaction prediction computer program comprising a neural network maintained in a memory, the neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier; a retrieval component configured to activate the neural network, to retrieve prediction data representing future interactions between customers and individual gaming machines, and to display a representation of the prediction data.

In a further form in broad terms the invention comprises a neural network training computer program comprising an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier; a retrieval component configured to retrieve from the interaction database data representing interactions between customers and gaming machines; a neural network maintained in a memory, the neural network configured to receive input data representing the data retrieved from the interaction database and to output prediction data representing future interactions between customers and individual gaming machines predicted by the neural network; and a training component configured to compare the data retrieved from the interaction database and the prediction data and to adjust the neural network based on the comparison.

In another form in broad terms the invention comprises a method of predicting interactions between customers and merchants, the method comprising the steps of

maintaining in a memory a neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier; activating the neural network; retrieving prediction data representing future interactions between customers and individual gaming machines from the neural network; and displaying a representation of the prediction data.

In yet another form in broad terms the invention comprises a method of training a neural network comprising the steps of maintaining in a memory an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier; retrieving from the interaction database data representing interactions between customers and gaming machines; configuring a neural network to receive input data representing the data retrieved from the interaction database and to output prediction data representing future interactions between customers and individual gaming machines predicted by the neural network; and comparing the data retrieved from the interaction database and the prediction data and adjusting the neural network based on the comparison.

BRIEF DESCRIPTION OF THE FIGURES

Preferred forms of the interaction prediction system and method will now be described with reference to the accompanying Figures in which:

Figure 1 shows a block diagram of a system in which one form of the invention may be implemented;

Figure 2 shows the preferred system architecture of hardware on which the present invention may be implemented;

Figure 3 shows a preferred database schema for storing interaction data;

Figure 4 is a block diagram of the preferred neural network of the invention;

Figure 5 is a flow chart of one method of training the neural network;

Figure 6 is a flow chart showing use of the trained neural network; and

Figure 7 is a data visualisation generated in accordance with one form of the invention.

CLAIMS

1. An interaction prediction system comprising:

a memory in which is maintained a neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier;

a retrieval component arranged to activate the neural network and to retrieve prediction data representing future interactions between customers and individual gaming machines; and

a display arranged to display a representation of the prediction data.

2. An interaction prediction system as claimed in claim 1 wherein the interaction data includes a monetary value for the interaction and wherein the neural network is trained on data including the monetary value of the interaction.

3. An interaction prediction system as claimed in claim 1 or claim 2 wherein the interaction data includes the date and/or time of the interaction and wherein the neural network is trained on data including the date and/or time of the interaction.

4. An interaction prediction system as claimed in any one of the preceding claims wherein the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is trained on data including the spatial position of the machine involved in the interaction.

5. An interaction prediction system as claimed in claim 4 wherein the neural network is trained on data including the machine identifier and/or spatial position of machines neighbouring the machine involved in the interactions.

6. A neural network training system comprising:

a memory in which is maintained an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier;

a retrieval component arranged to retrieve from the interaction database data representing interactions between customers and gaming machines;

a neural network arranged to receive input data representing the data retrieved from the interaction database and to output prediction data representing

future interactions between customers and individual gaming machines predicted by the neural network; and

a training component arranged to compare the data retrieved from the interaction database and the prediction data and to adjust the neural network based on the comparison.

7. A neural network training system as claimed in claim 6 wherein the interaction data includes a monetary value for the interaction and wherein the neural network is further arranged to receive as input the monetary value of the interaction.

8. A neural network training system as claimed in claim 6 or claim 7 wherein the interaction data includes the date and/or time of the interaction, the neural network further arranged to receive as input the date and/or time of interactions between customers and merchants.

9. A neural network training system as claimed in any one of claims 6 to 8 wherein the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is further arranged to receive as input the spatial position of the machine involved in the interaction.

10. A neural network training system as claimed in any one of claims 6 to 9 wherein the neural network is arranged to receive as input the machine identifier and/or spatial position of machines neighbouring the machine involved in the interactions.

11. An interaction prediction computer program comprising:

a neural network maintained in a memory, the neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier;

a retrieval component configured to activate the neural network, to retrieve prediction data representing future interactions between customers and individual gaming machines, and to display a representation of the prediction data.

12. A computer program as claimed in claim 11 wherein the interaction data includes a monetary value for the interaction and wherein the neural network is trained on data including the monetary value of the interaction.

13. A computer program as claimed in claim 11 or claim 12 wherein the interaction data includes the date and/or time of the interaction and wherein the neural network is trained on data including the date and/or time of the interaction.

14. A computer program as claimed in any one of claims 11 to 13 wherein the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is trained on data including the spatial position of the machine involved in the interaction.

15. A computer program as claimed in claim 14 wherein the neural network is trained on data including the machine identifier and/or spatial position of machines neighbouring the machine involved in the interactions.

16. A computer program as claimed in any one of claims 11 to 15 embodied on a computer readable medium.

17. A neural network training computer program comprising:

an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier;

a retrieval component configured to retrieve from the interaction database data representing interactions between customers and gaming machines;

a neural network maintained in a memory, the neural network configured to receive input data representing the data retrieved from the interaction database and to output prediction data representing future interactions between customers and individual gaming machines predicted by the neural network; and

a training component configured to compare the data retrieved from the interaction database and the prediction data and to adjust the neural network based on the comparison.

18. A computer program as claimed in claim 17 wherein the interaction data includes a monetary value for the interaction and wherein the neural network is further configured to receive as input the monetary value of the interaction.

19. A computer program as claimed in claim 17 or claim 18 wherein the interaction data includes the date and/or time of the interaction, the neural network

further configured to receive as input the date and/or time of interactions between customers and merchants.

20. A computer program as claimed in any one of claims 17 to 19 wherein the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is further configured to receive as input the spatial position of the machine involved in the interaction.

21. A computer program as claimed in any one of claims 17 to 20 wherein the neural network is arranged to receive as input the machine identifier and/or spatial position of machines neighbouring the machine involved in the interactions.

22. A computer program as claimed in any one of claims 17 to 21 embodied on a computer readable medium.

23. A method of predicting interactions between customers and merchants, the method comprising the steps of:

maintaining in a memory a neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier;

activating the neural network;

retrieving prediction data representing future interactions between customers and individual gaming machines from the neural network; and

displaying a representation of the prediction data.

24. A method as claimed in claim 23 wherein the interaction data includes a monetary value for the interaction and wherein the neural network is trained on data including the monetary value of the interaction.

25. A method as claimed in claim 23 or claim 24 wherein the interaction data includes the date and/or time of the interaction and wherein the neural network is trained on data including the date and/or time of the interaction.

26. A method as claimed in any one of claims 23 to 25 wherein the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is trained on data including the spatial position of the machine involved in the interaction.

27. A method as claimed in claim 26 wherein the neural network is trained on data including the machine identifier and/or spatial position of machines neighbouring the machine involved in the interactions.

28. A method of training a neural network comprising the steps of:

maintaining in a memory an interaction database of interaction data representing interactions between customers and gaming machines, the interaction data including a gaming machine identifier;

retrieving from the interaction database data representing interactions between customers and gaming machines;

configuring a neural network to receive input data representing the data retrieved from the interaction database and to output prediction data representing future interactions between customers and individual gaming machines predicted by the neural network; and

comparing the data retrieved from the interaction database and the prediction data and adjusting the neural network based on the comparison.

29. A method as claimed in claim 28 wherein the interaction data includes a monetary value for the interaction and wherein the neural network is further configured to receive as input the monetary value of the interaction.

30. A method as claimed in claim 28 or claim 29 wherein the interaction data includes the data and/or time of the interaction, the neural network further configured to receive as input the date and/or time of interactions between customers and merchants.

31. A method as claimed in any one of claims 28 to 30 wherein the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is further configured to receive as input the spatial position of the machine involved in the interaction.

32. A method as claimed in any one of claims 28 to 31 wherein the neural network is arranged to receive as input the machine identifier and/or spatial position of machines neighbouring the machine involved in the interactions.

33. A neural network trained by the method as claimed in any one of claims 28 to 32.

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* 26123GWW/MDA

Box No. I TITLE OF INVENTION

INTERACTION PREDICTION SYSTEM AND METHOD

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

COMPUDIGM INTERNATIONAL LIMITED
Level 16, Compudigm House
49 Boulcott Street
Wellington
NEW ZEALAND

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: NEW ZEALAND

State *(that is, country)* of residence: NEW ZEALAND

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

CARDNO, ANDREW JOHN
Level 16, Compudigm House
49 Boulcott Street
Wellington
NEW ZEALAND

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: NEW ZEALAND

State *(that is, country)* of residence: NEW ZEALAND

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

BENNETT, Michael Roy; WEST-WALKER, Gregory James; RUTLEDGE, Sue Moira; ADAMS, Matthew Dickson of WEST-WALKER BENNETT
Mobil on the Park
157 Lambton Quay
Wellington, New Zealand

Telephone No. +64 4 499 9058

Facsimile No. +64 4 499 9306

Teleprinter No.

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ☒ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
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- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* . . . . . .

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- ☒ AE United Arab Emirates
- ☒ AG Antigua and Barbuda
- ☒ AL Albania . . . . . .
- ☒ AM Armenia . . . . . .
- ☒ AT Austria . . . . . .
- ☒ AU Australia . . . . . .
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- ☒ BA Bosnia and Herzegovina . . . . . .
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- ☒ BG Bulgaria . . . . . .
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- ☒ DK Denmark . . . . . .
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- ☒ DZ Algeria . . . . . .
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- ☒ GH Ghana . . . . . .
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- ☒ ID Indonesia
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- ☒ IS Iceland
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- ☒ KE Kenya . . . . . .
- ☒ KG Kyrgyzstan . . . . . .
- ☒ KP Democratic People's Republic of Korea . . . . . .
- ☒ KR Republic of Korea . . . . . .
- ☒ KZ Kazakhstan . . . . . .
- ☒ LC Saint Lucia
- ☒ LK Sri Lanka
- ☒ LR Liberia
- ☒ LS Lesotho . . . . . .
- ☒ LT Lithuania
- ☒ LU Luxembourg
- ☒ LV Latvia
- ☒ MA Morocco . . . . . .
- ☒ MD Republic of Moldova . . . . . .
- ☒ MG Madagascar . . . . . .
- ☒ MK The former Yugoslav Republic of Macedonia . . . . . .
- ☒ MN Mongolia
- ☒ MW Malawi . . . . . .
- ☒ MX Mexico . . . . . .
- ☒ MZ Mozambique
- ☒ NO Norway
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- ☒ SD Sudan
- ☒ SE Sweden
- ☒ SG Singapore
- ☒ SI Slovenia . . . . . .
- ☒ SK Slovakia . . . . . .
- ☒ SL Sierra Leone . . . . . .
- ☒ TJ Tajikistan . . . . . .
- ☒ TM Turkmenistan . . . . . .
- ☒ TR Turkey . . . . . .
- ☒ TT Trinidad and Tobago . . . . . .
- ☒ TZ United Republic of Tanzania
- ☒ UA Ukraine . . . . . .
- ☒ UG Uganda . . . . . .
- ☒ US United States of America . . . . . .
- ☒ UZ Uzbekistan . . . . . .
- ☒ VN Viet Nam . . . . . .
- ☒ YU Yugoslavia . . . . . .
- ☒ ZA South Africa . . . . . .
- ☒ ZW Zimbabwe . . . . . .

Check-box reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ . . . . . .

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 13 July 1999 13/07/1999	336743	New Zealand		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): 1

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)* : ISA/ AUSTRALIA

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date *(day/month/year)* Number Country *(or regional Office)*

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets:**

request	:	3
description (excluding sequence listing part)	:	12
claims	:	7
abstract	:	1
drawings	:	7
sequence listing part of description	:	
Total number of sheets	:	30

This international application is **accompanied** by the item(s) marked below:

1. ☐ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☐ other *(specify)*:

Figure of the drawings which should accompany the abstract: 1

Language of filing of the international application: ENGLISH

Box No. IX SIGNATURE OF APPLICANT OR AGENT

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Title of the invention
Interaction Prediction System and Method

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(71) Applicant *(for all designated States except US)*: **COMPUDIGM INTERNATIONAL LIMITED** [NZ/NZ]; Level 16, Compudigm House, 49 Boulcott Street, Wellington (NZ).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **CARDNO, Andrew, John** [NZ/NZ]; Level 16, Compudigm House, 49 Boulcott Street, Wellington (NZ).

(74) Agents: **BENNETT, Michael, Roy** et al.; West-Walker Bennett, Mobil on the Park, 157 Lambton Quay, Wellington (NZ).

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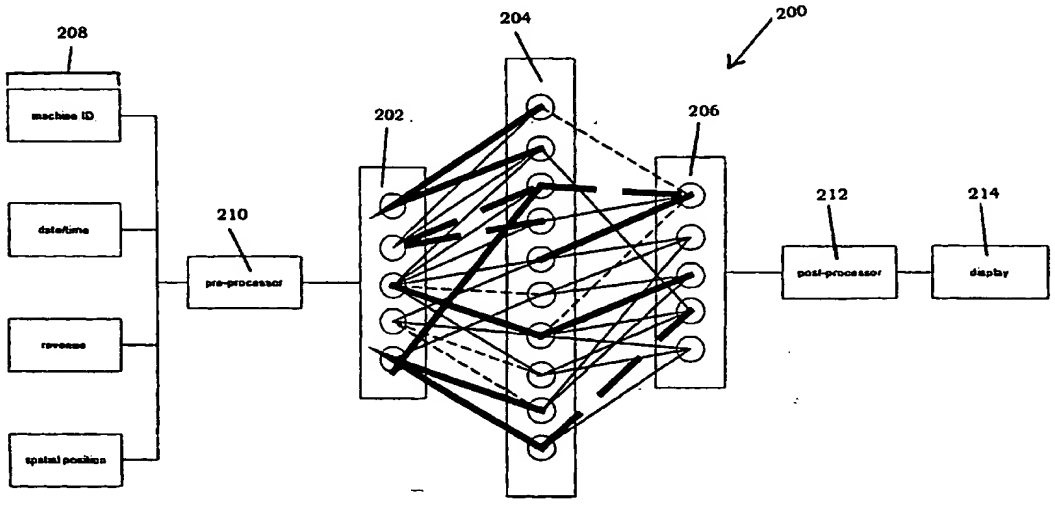

(57) Abstract: A neural network (200) is trained on an interaction database of data representing interactions between customers and merchants. The neural network (200) can then be used to predict future interactions between customers and merchants, and display means (214) are used to display a representation of the predicted interaction data. In one embodiment the merchants operate a casino or gaming venue including one or more gaming machines, and the interaction database includes data (208) representing curstomers' interactions with the one or more gaming machines.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERACTION PREDICTION SYSTEM AND METHOD

FIELD OF INVENTION

The invention relates to an interaction prediction system and method, particularly but not solely designed for predicting future revenue from individual gaming machines in a casino.

BACKGROUND TO INVENTION

The low cost of data storage hardware has led to the collection of large volumes of data. Merchants, for example, generate and collect large volumes of data during the course of their business. To compete effectively, it is necessary for a merchant to be able to identify and use information hidden in the collected data. This data could include revenue from gaming machines in a casino. The task of identifying this hidden information has proved very difficult for merchants.

Traditionally, analysis of data has been achieved by running a query on a set of data records stored in a database. The merchant or other party first creates a hypothesis, converts this hypothesis to a query, runs the query on the database, and interprets the results with respect to the original hypothesis.

One disadvantage of this verification-driven hypothesis approach is that the merchant must form the desired hypothesis in advance. This is merely confirming what the merchant already suspects and does not provide the merchant with information which may be unexpected. Another disadvantage is that the merchant needs to have available the technical knowledge to formulate what are often very difficult and complex queries.

SUMMARY OF INVENTION

In broad terms the invention comprises an interaction prediction system comprising a memory in which is maintained a neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and merchants; retrieval means arranged to activate the neural network and to retrieve prediction data representing future interactions between customers and merchants; and display means arranged to display a representation of the prediction

In another form in broad terms the invention comprises a neural network training system comprising a memory in which is maintained an interaction database of interaction data representing interactions between customers and merchants; retrieval means arranged to retrieve from the interaction database data representing interactions between customers and merchants; a neural network arranged to receive input data representing the data retrieved from the interaction database and to output prediction data representing interaction data predicted by the neural network; and training means arranged to compare the data retrieved from the interaction database and the prediction data and to adjust the neural network based on the comparison.

In another form in broad terms the invention comprises an interaction prediction computer program comprising a neural network maintained in a memory, the neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and merchants; retrieval means arranged to activate the neural network and to retrieve prediction data representing future interactions between customers and merchants; and display means arranged to display a representation of the prediction data.

In a further form in broad terms the invention comprises a neural network training computer program comprising an interaction database of interaction data representing interactions between customers and merchants maintained in a memory; retrieval means arranged to retrieve from the interaction database data representing interactions between customers and merchants; a neural network maintained in a memory, the neural network arranged to receive input data representing the data retrieved from the interaction database and to output prediction data representing interaction data predicted by the neural network; and training means arranged to compare the data retrieved from the interaction database and the prediction data and to adjust the neural network based on the comparison.

In another form in broad terms the invention comprises a method of predicting interactions between customers and merchants, the method comprising the steps of maintaining in a memory a neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and merchants; activating the neural network; retrieving prediction data representing future interactions between customers and merchants from the neural network; and displaying a representation of the prediction data.

In another form in broad terms the invention comprises a method of training a neural network comprising the steps of maintaining in a memory an interaction database of interaction data representing interactions between customers and merchants; retrieving from the interaction database data representing interactions between customers and merchants; arranging a neural network to receive input data representing the data retrieved from the interaction database and to output prediction data representing interaction data predicted by the neural network; and comparing the data retrieved from the interaction database and the prediction data and adjusting the neural network based on the comparison.

BRIEF DESCRIPTION OF THE FIGURES

Preferred forms of the interaction prediction system and method will now be described with reference to the accompanying Figures in which:

Figure 1 shows a block diagram of a system in which one form of the invention may be implemented;

Figure 2 shows the preferred system architecture of hardware on which the present invention may be implemented;

Figure 3 shows a preferred database schema for storing interaction data;

Figure 4 is a block diagram of the preferred neural network of the invention;

Figure 5 is a flow chart of one method of training the neural network;

Figure 6 is a flow chart showing use of the trained neural network; and

Figure 7 is a data visualisation generated in accordance with one form of the invention.

DETAILED DESCRIPTION OF PREFERRED FORMS

Figure 1 illustrates a block diagram of the preferred system 10 in which one form of the present invention 12 may be implemented. The invention 12 is arranged to compile data from a merchant premises 20.

Typically, a merchant will operate in a commercial premises or store from which a customer purchases goods or services. The merchant may, for example, operate a petrol station in one or more geographic locations. The merchant may alternatively operate a wagering or betting service, or operate a casino or other gaming facility in which a number of gaming machines and stations are positioned in one or more rooms at a common venue.

In Figure 1, merchant 20 operates a casino having several gaming machines available for interactions with customers in the merchant premises. Gaming machines could be grouped together into machine banks, for example bank 22 and bank 24. The merchant may also operate individual gaming machines, for example machines 26 and 28. Each of the machines in machine banks 22 and 24 and machines 26 and 28 are preferably connected to the invention 12 with a suitable device such as data bus 30, enabling data to be transferred between the machines and the invention 12.

Each machine may be provided with one or more electronic meters, for example a timer, whether the machine is in use, the money placed in the machine or revenue, credit wins (how much money the machine pays back) and how much money is to be paid back by a teller. The data could be transferred in real time to the invention 12 or alternatively the meters could be updated locally at the machine and each machine polled periodically by the invention 12.

The system 10 preferably includes one or more clients 40, for example 40A, 40B, 40C, 40D, 40E and 40F, which each may comprise a personal computer or workstation described below. Each client 40 is interfaced to the invention 12 as shown in Figure 1. Each client 40 could be connected directly to the invention 12, could be connected through a local area network or LAN, or could be connected through the Internet.

Clients 40A and 40B, for example, are connected to a network 42, such as a local area network or LAN. The network 42 could be connected to a suitable network

server 44 and communicate with the invention 12 as shown. Client 40C is shown connected directly to the invention 12. Clients 40D, 40E and 40F are shown connected to the invention 12 through the Internet 46. Client 40D is shown as connected to the Internet 46 with a dial-up connection and clients 40E and 40F are shown connected to a network 48 such as a local area network or LAN, with the network 48 connected to a suitable network server 50.

One preferred form of the invention 12 comprises a personal computer or workstation operating under the control of appropriate operating and application software having a data memory 50 connected to a server 52. The invention is arranged to retrieve or compile data from the merchant premises 20, process the data with the server 52 and to display the data on a client workstation 40, as will be described below.

Figure 2 shows the preferred system architecture of a client 40 or invention 12. The computer system 60 typically comprises a central processor 62, a main memory 64 for example RAM, and an input/output controller 66. The computer system 60 also comprises peripherals such as a keyboard 68, a pointing device 70 for example a mouse, touch pad or track ball, a display or screen device 72, a mass storage memory 74 for example a hard disk, floppy disk or optical disc, and an output device 76 for example a printer. The system 60 could also include a network interface card or controller 78 and/or a modem 80. The individual components of the system 60 could communicate through a system bus 82.

As a customer interacts with a merchant, the interaction generates interaction data which is then migrated to the data memory 50. Migration may be performed, for example, by way of daily updates. It is advantageous to cleanse, catalogue and validate the interaction data during migration of the data to the memory and this could be performed by either the merchant or a third party. The interaction data could be stored in a number of records in a relational database. Figure 3 illustrates a typical database schema for storing interaction data. Each interaction record 100 could include an interaction identifier 102 which uniquely identifies the particular interaction between customer and merchant.

Where the merchant operates a casino or gaming facility, the merchant may have assigned to each individual gaming machine a machine identifier. The merchant may also assign a group identifier to a pre-specified group of machines and may also assign a machine bank identifier to a bank of gaming machines. The interaction

record 100 could include a machine identifier, a machine group identifier, and a machine bank identifier indicated at 104, 106 and 108 respectively.

The record 100 could also include a customer identifier 110. The merchant may, for example, issue an incentive supported customer loyalty card which is then used by the customer during interactions with the merchant. The loyalty card preferably has stored on it a customer identifier. Alternatively, if the customer pays for the interaction using a credit card, EFTPOS or stored value card, the customer identifier could include an identifier obtained from the card.

The record may also include data such as the date and/or time at which the interaction between the customer and the merchant took place shown at 112. Where it is envisaged that the interactions could be prolonged, for example where a customer maintains an interaction with a gaming machine, the date/time identifier 112 could include the date/time when the interaction commenced and the date/time when the interaction was terminated.

The record 100 could also include the value 114 of the interaction, for example the money transferred from the customer to the gaming machine, and where the machine is arranged to make payouts to the customer, the net value of the interaction.

The interaction data could also include the spatial position of gaming machines, as is more particularly described in our patent specification PCT/NZ00/00101 to Compudigm International Limited filed on 19 June 2000 entitled "Spatial Data Management System and Method" which is incorporated by reference.

The database schema could include a further database table 150 for storing the spatial location of individual machines. It will be appreciated that this table could be normalised to an appropriate extent to avoid data redundancy. It will also be appreciated that table 150 could alternatively be represented in an object-oriented form.

A typical record 150 could include a machine identifier 152 to identify the particular gaming machine. The record preferably represents each gaming machine as a set of vertices which together define the polygon representing a 2-dimensional plan view of each machine. Each data set preferably defines the geographic co-ordinates of the vertices of each polygon.

Table 150 could include a vertex identifier 154 to identify an individual vertex of a particular gaming machine. Position data such as x co-ordinates indicated at 156 and y co-ordinates indicated at 158 could represent the geographic position of an individual vertex in the New Zealand Map Grid (NZMG) Local Co-ordinate System Notation. It is envisaged that the geographic co-ordinates could alternatively be represented in Australian Map Grid (AMG) Notation, in WGS84, or as a latitude or longitude, or in any other suitable map grid notation system.

The schema 150 could also include a date and/or time field 160 for storing the date and/or time a particular machine location record is created or edited. This would enable the invention to keep track of changes made to the positions of individual gaming machines stored in the database.

Referring to Figure 4, in one preferred form of the invention, a neural network 200 is arranged to run on the server 52. The preferred neural network could be implemented in C++, Visual Basic, or another object-oriented language suitable for the purpose. Where the system includes only one processor or server, each neuron could be arranged to run on that processor. Where the system includes more than one processor, the neurons could be arranged to run on different processors. Ideally each neuron will run on a separate processor.

The preferred neural network 200 is a multi layer perceptron having an input layer 202, a hidden layer 204, and an output layer 206. It is envisaged that the network 200 could include more than one hidden layer. The input layer 202 and output layer 206 are shown as including 5 nodes and the hidden layer 204 shown as including 10 nodes. It will be appreciated that the number of nodes in each of the layers could be varied significantly. It is however usual that where there is n nodes in the input layer there are $n(n-1)/2$ nodes in the hidden layer.

Signals are received by one or more nodes in the input layer 202. These signals are transformed and output to nodes in the hidden layer 204. As shown in Figure 4, the neural network 200 may be arranged so that output signals from each node in the input layer 202 are sent to each node in the hidden layer 204.

The output signal from each node in the input layer 202 could be multiplied by a weight before reaching a node in the hidden layer 204. In Figure 4, for example, signals having positive weights are shown as solid lines, while signals having

negative weights are shown as dotted lines. The absolute value of the weight may also be varied, and in Figure 4 the thickness of the line indicating a signal is proportional to the absolute value of the weight on that signal.

Signals received by nodes in the hidden layer 204 are transformed and output to one or more nodes in the output layer 206. Each node in the hidden layer 204 may be arranged to send an output signal to the output layer 206.

Once again, the signals may be weighted, and positive weights are indicated as solid lines and negative weights are indicated as dotted lines. The absolute value of the weight may also be varied, and the thickness of the line is proportional to the absolute value of the weight attached to a particular signal.

The preferred neural network is arranged so that each node receives a signal as input, performs a transfer or activation function on the signal, and outputs a numerical value as a result of this function. This transfer function could be, for example, the following logistic function:

$$out = f(in) = \frac{1}{1 + \exp^{-in}}$$

Advantages of this logistic function are that it is infinitely differentiable, it is smooth, monotonically increasing, and maps the real line on the (0,1) interval. If the original signal is too strong, it will give an output close to 1. If the signal is too weak, it will give an output close to 0.

It is envisaged that other known functions suitable for the purpose could replace the above logistic function, for example a linear function such as:

$$out = f(in) = \frac{1}{L(in)}$$

where L is a linear function.

Although the preferred neural network is arranged so that nodes in the input layer 202 send output signals to the nodes in the hidden layer 204, and nodes in the hidden layer 204 send output signals to node(s) in the output layer 206, it is envisaged that some nodes in the input layer 202 may be arranged to transfer signals directly to node(s) in the output layer 206. Such direct connections may be suitable for approximating linear functions. It is also envisaged, as shown in Figure 4, that some nodes in the input layer do not send signals to all nodes in the notation layer, and some nodes in the hidden layer do not send signals to all nodes in the output layer.

The neural network 200 is preferably trained on interaction data retrieved from the data memory 50. Interaction records as indicated at 208 could include the machine, group and/or machine bank identifier, the date/time, the revenue and/or the spatial position. Each interaction record is preferably fed to a pre-processor 210 which could transform the input data into a manner suitable for the neural network 200. The range of values could be transformed, for example, so that the values belong in the (0,1) interval.

The pre-processor 210 could also determine the particular data on which the neural network will be trained. The pre-processor, for example, could assign null weights to various fields of the interaction records with the result that this information is not fed to the neural network. Other fields which could be more important are assigned non-null weights and could also be ranked above other non-null weights. The pre-processor could include a linear function, a non-linear function and/or another neural network to transform the values to a range suitable for the neural network 200.

The neural network 200 could also include a post-processor 212 which could be arranged to apply the inverse function used by the pre-processor 210 and display the output value or values in a suitable format with a display means 214. It is envisaged that post-processing could include a linear function, a non-linear function or another neural network.

Figure 5 illustrates one preferred method of training the neural network. The network is first initialised by setting initial signal weights as indicated at 300. One method of initialisation involves setting weights to random values initially.

As indicated at 302, data representing interactions between customers and merchants is retrieved from memory 50. As shown at 304, the data retrieved from memory 50 could undergo pre-processing. The data could be transformed in a manner suitable for the neural network, for example the range of values could be transformed so that the values belong in the (0,1) interval. The data could be scaled by a preprocessing function so that the maximum input values would be scaled to 1, and values less than the maximum lie between 0 and 1. The pre-processing function could include a linear function, a non-linear function, or another neural network, to transform the values to a range suitable for the purpose.

As shown in 306, the data is then fed to the neural network. It will be appreciated that this data could be raw data retrieved from the memory at step 302, could be data preprocessed by the step of 304, or could be a mix of raw and processed data.

The neural network then acts on the input data and produces an output value or values. This output value could be in the (0,1) interval where the input data has been preprocessed. Postprocessing may then be performed, as indicated at 307 by applying the inverse function used for preprocessing and displaying the output value as a revenue currency value. It is envisaged that postprocessing could include a linear function, a non-linear function, or another neural network.

The output value produced by the neural network represents the predicted value retrieved at step 308, and by calculating the actual value from data retrieved from the memory, the correctness of the predicted value can be determined as the fit of the predicted data to the actual data as indicated at 312. For example, where the neural network is trained to predict the revenue of a gaming machine or machine bank, the value output by the neural network could be compared to the actual revenue generated by the machine or machine bank.

The weights of the network can then be adjusted as shown at 314, based on the comparison between the predicted data and the actual data. These weights may be adjusted by any known algorithm suitable for the purpose, for example, a back propagation algorithm. If the predicted data is not a good fit to the actual data, the learning algorithm may be repeated and the weights adjusted until such time as a good fit is obtained.

Once learning is complete, the neural network may then be used to predict future interactions. Figure 6 illustrates use of the preferred system for this purpose. The

neural network is first activated as shown at 400. The network calculates and outputs predicted data representing future interactions between customers and merchants.

As indicated at 402, this data is retrieved from the neural network and as shown at 404, the data is displayed to the user, following which the neural network is deactivated as shown at 406.

The invention in one further preferred form could be arranged to display a contoured representation of data superimposed on a graphical spatial representation of the premises of the merchant generated by the system. Contoured representations are further described in our patent specification PCT/NZ00/00099 to Compudigm International Limited filed on 14 June 2000 entitled "Data Visualisation System and Method" which is incorporated by reference.

Figure 7 illustrates at 600 one example of a display generated by the system where the merchant operates a casino or similar gaming venue. In this example, a representation of the merchant is generated and displayed in accordance with the invention. The graphical representation comprises a spatial representation of an area of the casino showing the layout of individual gaming machines and machine banks, two of which are indicated at 602 and 604 respectively.

The representation 600 could be arranged to display the revenue obtained from an individual gaming machine or could display some other key performance indicator. The revenue for each machine is preferably graphically represented adjacent or near to the representation of the individual machine. There are a finite number of machines in the casino, and the individual revenues generated from each machine represent a finite set of data values. These data values are graphically illustrated as data points in the representation 600. For example, the revenue or data value for machine 602 is graphically illustrated as data point 606 and the data value or revenue for machine 604 is graphically illustrated as data point 608.

The preferred representation 600 is colour-coded and the value of revenue of each machine is illustrated by representing the corresponding data points in the appropriate colour to represent the correct value of revenue of each machine. It is envisaged that the invention could also display both predicted and actual data values.

The areas of the representation 600 around each data point are shown as contours. The nature of the contours for each data point are preferably represented to gradually drop off or fall away from each data point. Each data point could be represented by x and y co-ordinates indicating the relative position of each data point in the representation. Each data point could also have a z value representing the height or magnitude of the data point. This z value could indicate, for example, the revenue or data value at a particular data point. Each data value is therefore centred on a data point.

In summary, the invention provides an interaction prediction system and method designed to assist a casino or gaming machine operator to predict future revenue from individual gaming machines in a casino. It will be appreciated that the same invention could also have application in other areas, for example, the layout and arrangement of products in retail premises and the resulting sales of those products.

The foregoing describes the invention including preferred forms thereof. Alterations and modifications as will be obvious to those skilled in the art are intended to be incorporated within the scope hereof, as defined by the accompanying claims.

CLAIMS

1. An interaction prediction system comprising:

a memory in which is maintained a neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and merchants;

retrieval means arranged to activate the neural network and to retrieve prediction data representing future interactions between customers and merchants; and

display means arranged to display a representation of the prediction data.

2. A system as claimed in claim 1 wherein the interaction data includes the date and/or time of the interaction and wherein the neural network is trained on data including the date and/or time of the interaction.

3. A system as claimed in claim 1 or claim 2 wherein one or more of the merchants operate from one or more commercial premises, the interaction data includes the monetary value of the interaction and wherein the neural network is trained on data including the monetary value of the interaction.

4. A system as claimed in claim 3 wherein one or more of the merchants operates a casino or gaming venue comprising one or more gaming machines, each gaming machine having a machine identifier.

5. A system as claimed in claim 4 wherein the interaction data includes a machine identifier for each interaction and wherein the neural network is trained on data including the machine identifier for interactions between customers and merchants.

6. A system as claimed in claim 4 or claim 5 wherein each gaming machine has a spatial position, the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is trained on data including the spatial position of the machine involved in the interaction.

7. A system as claimed in claim 6 wherein the neural network is trained on data including the machine identifier and/or spatial position of machines neighbouring each machine involved in interactions between customers and merchants.

8. A neural network training system comprising:

a memory in which is maintained an interaction database of interaction data representing interactions between customers and merchants;

retrieval means arranged to retrieve from the interaction database data representing interactions between customers and merchants;

a neural network arranged to receive input data representing the data retrieved from the interaction database and to output prediction data representing interaction data predicted by the neural network; and

training means arranged to compare the data retrieved from the interaction database and the prediction data and to adjust the neural network based on the comparison.

9. A neural network training system as claimed in claim 8 wherein the interaction data includes the date and/or time of the interaction, the neural network further arranged to receive as input the date and/or time of interactions between customers and merchants.

10. A neural network training system as claimed in claim 8 or claim 9 wherein one or more merchants operates from one or more commercial premises, the interaction data includes the monetary value of the interaction and wherein the neural network is further arranged to receive as input the monetary value of the interaction.

11. A neural network training system as claimed in claim 10 wherein the merchant operates a casino or gaming venue comprising one or more gaming machines, each gaming machine having a machine identifier.

12. A neural network training system as claimed in claim 11 wherein the interaction data includes a machine identifier for each interaction, the neural network further arranged to receive as input the machine identifier for interactions between customers and merchants.

13. A neural network training system as claimed in claim 11 or claim 12 wherein each gaming machine has a spatial position, the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is further arranged to receive as input the spatial position of the machine involved in the interaction.

14. A neural network training system as claimed in claim 13 wherein the neural network is arranged to receive as input the machine identifier and/or spatial position of machines neighbouring each machine involved in interactions between customers and merchants.

15. An interaction prediction computer program comprising:

a neural network maintained in a memory, the neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and merchants;

retrieval means arranged to activate the neural network and to retrieve prediction data representing future interactions between customers and merchants; and

display means arranged to display a representation of the prediction data.

16. A computer program as claimed in claim 15 wherein the interaction data includes the date and/or time of the interaction and wherein the neural network is trained on data including the date and/or time of the interaction.

17. A computer program as claimed in claim 15 or claim 16 wherein one or more of the merchants operate from one or more commercial premises, the interaction data includes the monetary value of the interaction and wherein the neural network is trained on data including the monetary value of the interaction.

18. A computer program as claimed in claim 17 wherein one or more of the merchants operates a casino or gaming venue comprising one or more gaming machines, each gaming machine having a machine identifier.

19. A computer program as claimed in claim 18 wherein the interaction data includes a machine identifier for each interaction and wherein the neural network is trained on data including the machine identifier for interactions between customers and merchants.

20. A computer program as claimed in claim 18 or claim 19 wherein each gaming machine has a spatial position, the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is trained on data including the spatial position of the machine involved in the interaction.

21. A computer program as claimed in claim 20 wherein the neural network is trained on data including the machine identifier and/or spatial position of machines neighbouring each machine involved in interactions between customers and merchants.

22. A computer program as claimed in any one of claims 15 to 21 embodied on a computer readable medium.

23. A neural network training computer program comprising:

an interaction database of interaction data representing interactions between customers and merchants maintained in a memory;

retrieval means arranged to retrieve from the interaction database data representing interactions between customers and merchants;

a neural network maintained in a memory, the neural network arranged to receive input data representing the data retrieved from the interaction database and to output prediction data representing interaction data predicted by the neural network; and

training means arranged to compare the data retrieved from the interaction database and the prediction data and to adjust the neural network based on the comparison.

24. A computer program as claimed in claim 23 wherein the interaction data includes the date and/or time of the interaction, the neural network further arranged to receive as input the date and/or time of interactions between customers and merchants.

25. A computer program as claimed in claim 23 or claim 24 wherein one or more merchants operates from one or more commercial premises, the interaction data includes the monetary value of the interaction and wherein the neural network is trained on data including the monetary value of the interaction.

26. A computer program as claimed in claim 25 wherein the merchant operates a casino or gaming venue comprising one or more gaming machines, each gaming machine having a machine identifier.

27. A computer program as claimed in claim 26 wherein the interaction data includes a machine identifier for each interaction, the neural network further

arranged to receive as input the machine identifier for interactions between customers and merchants.

28. A computer program as claimed in claimed in claim 26 or claim 27 wherein each gaming machine has a spatial position, the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is further arranged to receive as input the spatial position of the machine involved in the interaction.

29. A computer program as claimed in claim 28 wherein the neural network is arranged to receive as input the machine identifier and/or spatial position of machines neighbouring each machine involved in interactions between customers and merchants.

30. A computer program as claimed in any one of claims 23 to 29 embodied on a computer readable medium.

31. A method of predicting interactions between customers and merchants, the method comprising the steps of:

maintaining in a memory a neural network trained on data retrieved from an interaction database of interaction data representing interactions between customers and merchants;

activating the neural network;

retrieving prediction data representing future interactions between customers and merchants from the neural network; and

displaying a representation of the prediction data.

32. A method as claimed in claim 31 wherein the interaction data includes the date and/or time of the interaction and wherein the neural network is trained on data including the date and/or time of the interaction.

33. A method as claimed in claim 31 or claim 32 wherein one or more of the merchants operate from one or more commercial premises, the interaction data includes the monetary value of the interaction and wherein the neural network is trained on data including the monetary value of the interaction.

34. A method as claimed in claim 33 wherein one or more of the merchants operates a casino or gaming venue comprising one or more gaming machines, each gaming machine having a machine identifier.

35. A method as claimed in claim 34 wherein the interaction data includes a machine identifier for each interaction and wherein the neural network is trained on data including the machine identifier for interactions between customers and merchants.

36. A method as claimed in claim 34 or claim 35 wherein each gaming machine has a spatial position, the interaction data includes the spatial position of the machine involved in the interaction and wherein the neural network is trained on data including the spatial position of the machine involved in the interaction.

37. A method as claimed in claim 36 wherein the neural network is trained on data including the machine identifier and/or spatial position of machines neighbouring each machine involved in interactions between customers and merchants.

38. A method of training a neural network comprising the steps of:

maintaining in a memory an interaction database of interaction data representing interactions between customers and merchants;

retrieving from the interaction database data representing interactions between customers and merchants;

arranging a neural network to receive input data representing the data retrieved from the interaction database and to output prediction data representing interaction data predicted by the neural network; and

comparing the data retrieved from the interaction database and the prediction data and adjusting the neural network based on the comparison.

39. A method of training a neural network as claimed in claim 38 wherein the interaction data includes the date and/or time of the interaction, the method comprising the step of arranging the neural network to receive as input the date and/or time of interactions between customers and merchants.

40. A method of training a neural network as claimed in claim 38 or claim 39 wherein one or more merchants operates from one or more commercial premises and the interaction data includes the monetary value of the interaction, the method

further comprising the step of arranging the neural network to receive as input the monetary value of the interaction.

41. A method of training a neural network as claimed in claim 40 wherein the merchant operates a casino or gaming venue comprising one or more gaming machines, each gaming machine having a machine identifier.

42. A method of training a neural network as claimed in claim 41 wherein the interaction data includes a machine identifier for each interaction, the method further comprising the step of arranging the neural network to receive as input the machine identifier for interactions between customers and merchants.

43. A method of training a neural network as claimed in claimed in claim 41 or claim 42 wherein each gaming machine has a spatial position and the interaction data includes the spatial position of the machine involved in the interaction, the method further comprising the step of arranging the neural network to receive as input the spatial position of the machine involved in the interaction.

44. A method of training a neural network as claimed in claim 43 further comprising the step of arranging the neural network to receive as input the machine identifier and/or spatial position of machines neighbouring each machine involved in interactions between customers and merchants.

45. A neural network trained by the method as claimed in any one of claims 38 to 44.

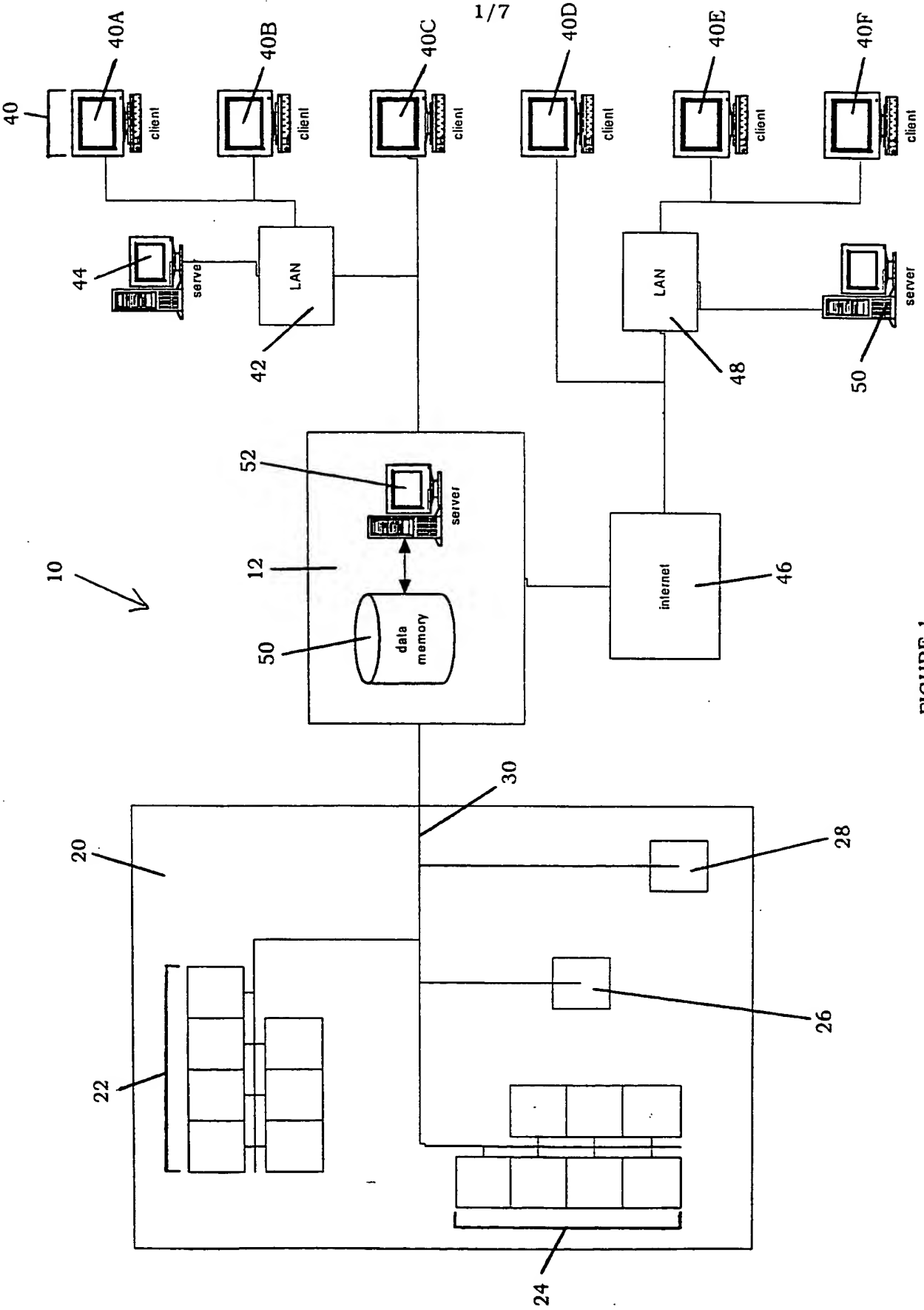
40
40A
client
40B
client
40C
client
40D
client
40E
client
40F
client
44
server
LAN
42
LAN
48
server
50
52
server
12
10
data memory
50
internet
46
30
20
28
26
22
24

FIGURE 1

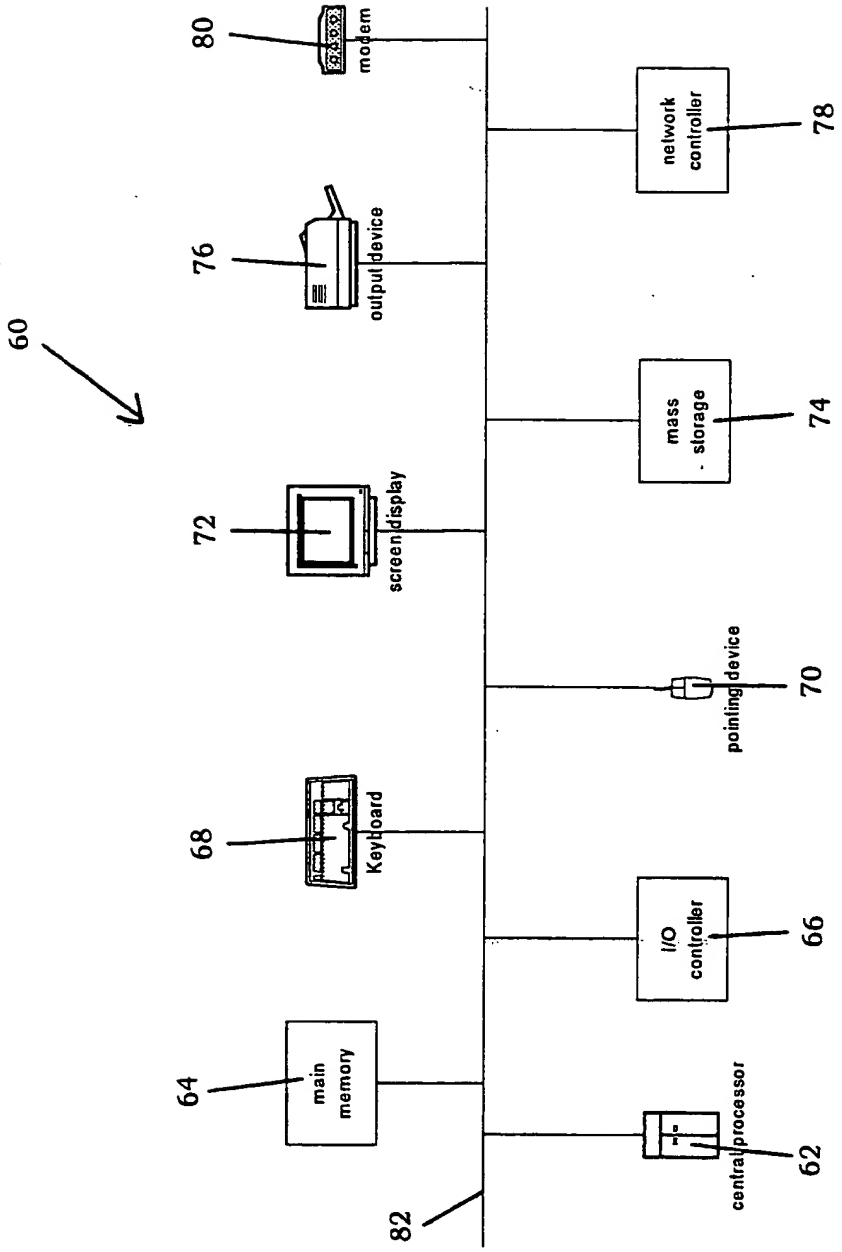
60
80
modem
network controller
78
76
output device
mass storage
74
72
screen display
pointing device
70
68
Keyboard
I/O controller
66
64
main memory
central processor
62
82

FIGURE 2

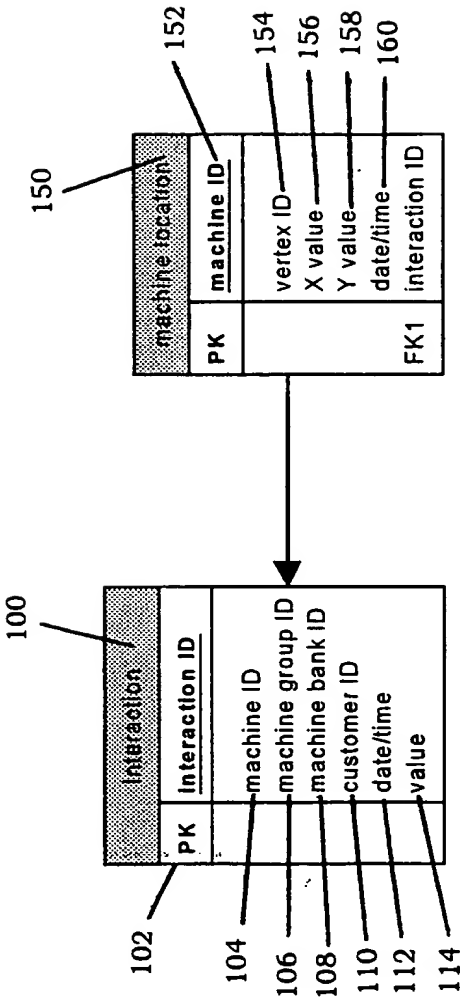
150
152
154
156
158
160
machine location
machine ID
PK
vertex ID
X value
Y value
date/time
interaction ID
FK1
100
Interaction
Interaction ID
PK
machine ID
machine group ID
machine bank ID
customer ID
date/time
value
102
104
106
108
110
112
114

FIGURE 3

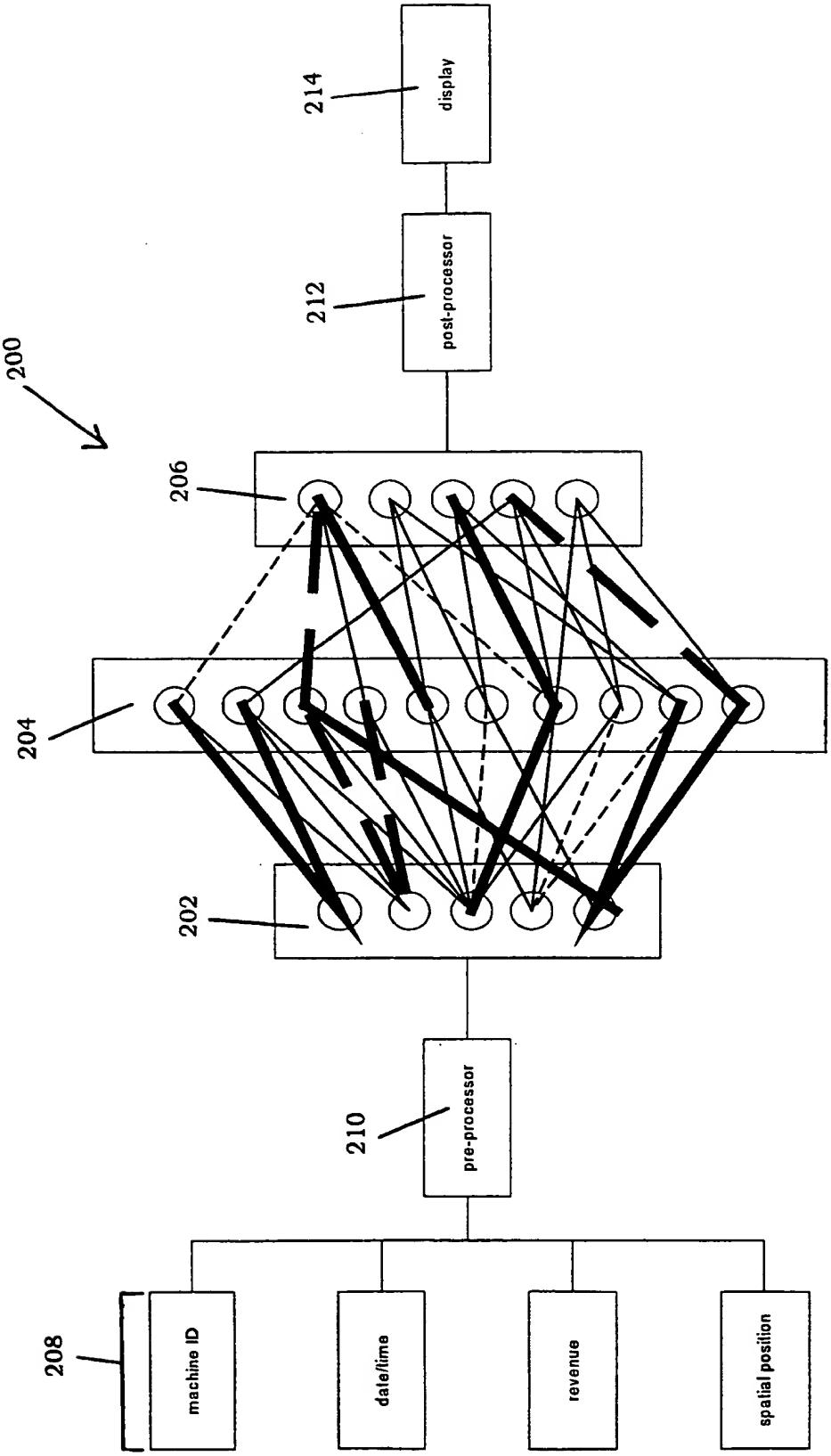
200
214
display
212
post-processor
206
204
202
210
pre-processor
208
machine ID
date/time
revenue
spatial position

FIGURE 4

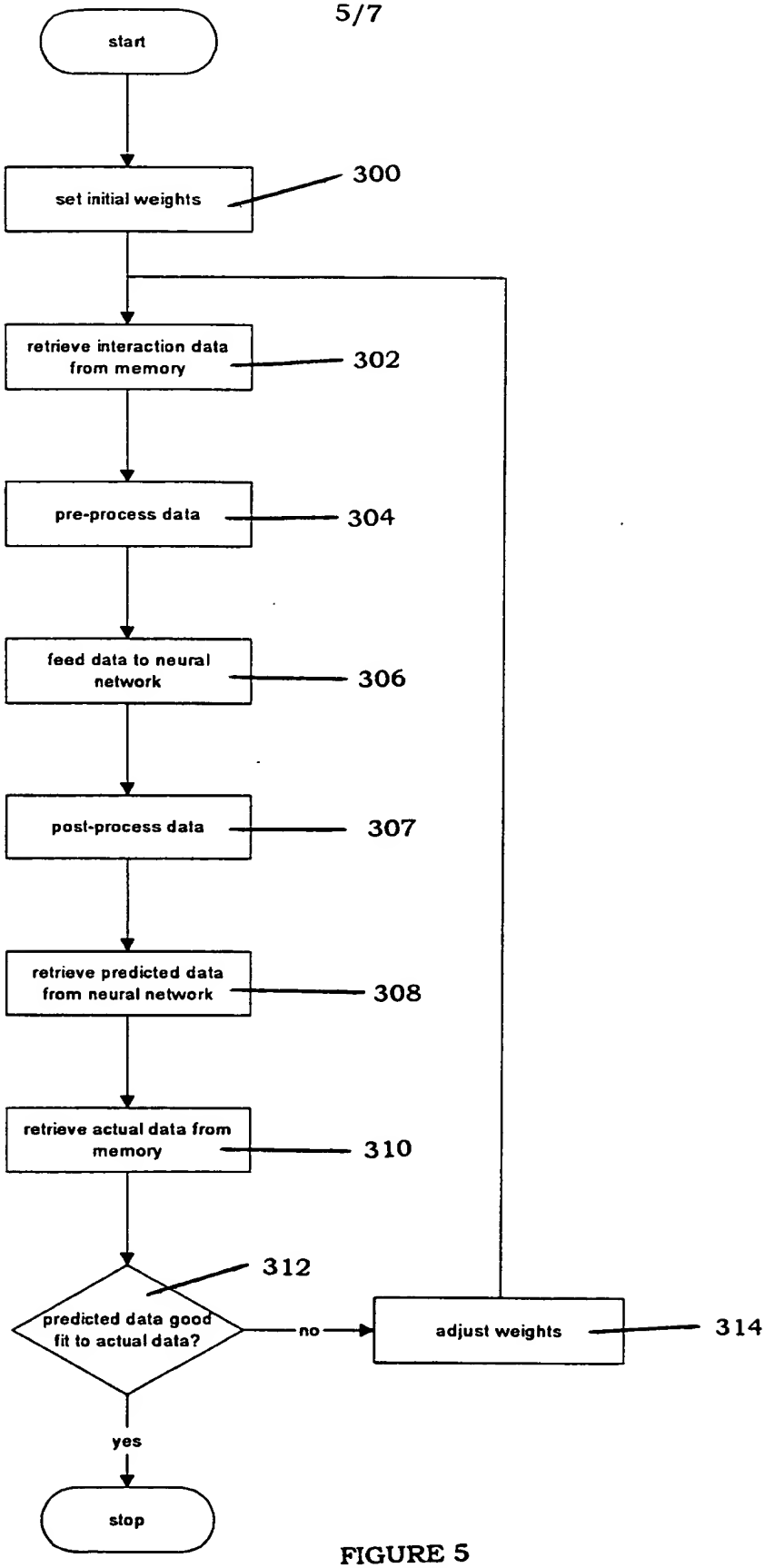
start
set initial weights
300
retrieve interaction data from memory
302
pre-process data
304
feed data to neural network
306
post-process data
307
retrieve predicted data from neural network
308
retrieve actual data from memory
310
312
predicted data good fit to actual data?
no
adjust weights
314
yes
stop

FIGURE 5

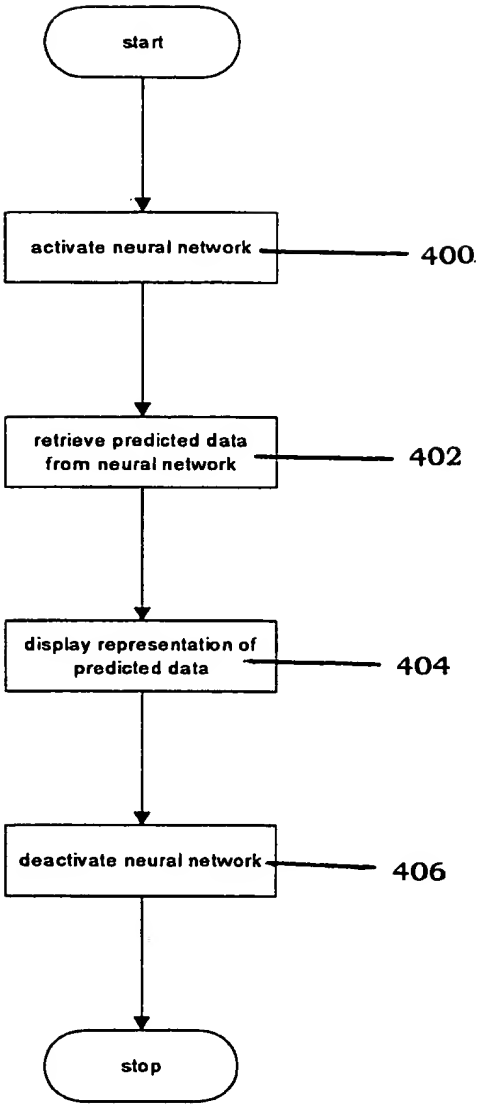
start
activate neural network
400
retrieve predicted data from neural network
402
display representation of predicted data
404
deactivate neural network
406
stop

FIGURE 6

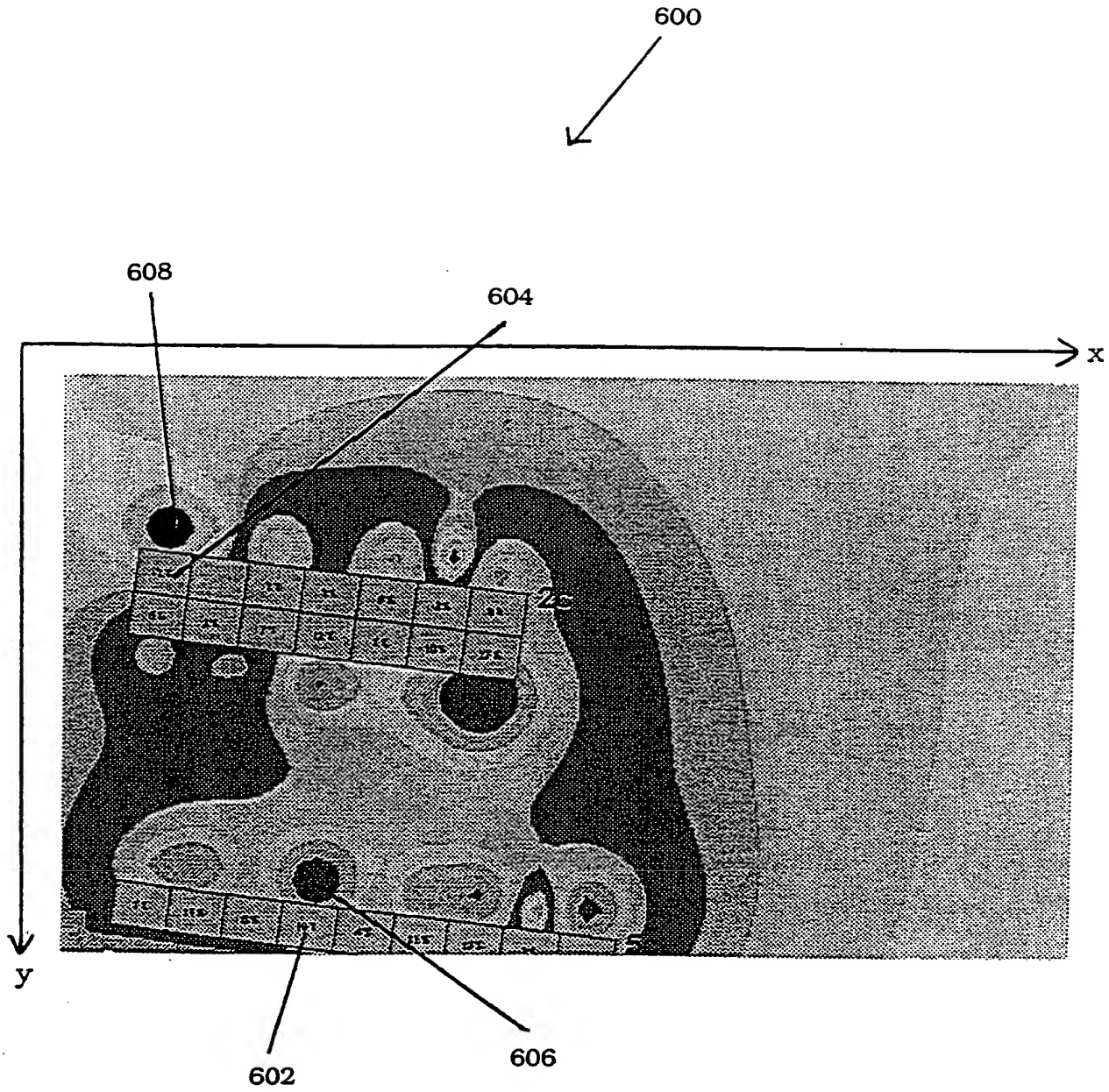

FIGURE 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ00/00125

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: G06F 17/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F 17/60

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT: neural AND (predict OR forecast) AND (merchant OR vendor OR seller OR sale OR customer OR buyer)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	US-6032125-A (ANDO) 29 February 2000 See whole document.	1 to 3, 8 to 10, 15 to 17, 23 to 25, 31 to 33, 38 to 40
P, X	US-6029139-A (CUNNINGHAM et al.) 22 February 2000 See whole document.	1 to 3, 8 to 10, 15 to 17, 23 to 25, 31 to 33, 38 to 40
X	US-5819226-A (GOPINATHAN et al.) 6 October 1998 See whole document.	1 to 3, 8 to 10, 15 to 17, 23 to 25, 31 to 33, 38 to 40

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
6 November 2000

Date of mailing of the international search report
10 NOV 2000 10 NOV 2000

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
E-mail address: pct@ipaustralia.gov.au
Facsimile No. (02) 6285 3929

Authorized officer

MICHAEL HARDY
Telephone No : (02) 6283 2547

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ00/00125

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US-5774868-A (CRAGUN et al.) 30 June 1998 See whole document.	1 to 3, 8 to 10, 15 to 17, 23 to 25, 31 to 33, 38 to 40
X	Patent Abstracts of Japan, JP-10005413-A (FUJI ELECTRIC CO., LTD. et al.) 13 January 1998	1 to 45
X	US-5444820-A (TZES et al.) 22 August 1995 See whole document.	1, 8, 15, 23, 31, 38.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/NZ00/00125

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	6032125	JP	10-143490				
US	5819226	DE	69315356	EP	669032	ES	2108880
		JP	8-504284	WO	9406103		

END OF ANNEX